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18. Continue

Reconnaissance, Detectors; (KT)

ANNEX B

DEPARTMENT OF THE NAVY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

RCS: DD-USDRE (A)1065

SECTION I

ON REPORT ON CHEMICAL WARFARE PROGRAM

1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

DEPARTMENT OF THE NAVY

RCS: DD-USDRE(A)1065

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT,
TEST AND EVALUATION FUNDS FOR THE PERIOD
1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985
REPORTING SERVICE: DEPARTMENT OF THE NAVY
DATE OF REPORT: 30 SEPTEMBER 1985
RCS: DD-USDRE(A)1065

DESCRIPTION OF RDT&E,N EFFORT FOR THE CHEMICAL WARFARE PROGRAM

During FY85, the Department of the Navy obligated $21,446,000.00 for general research investigations, development and test of chemical warfare agents, weapon systems and defensive equipment.

		FUNDS OBLIGATED ($000)		
Current Fiscal Year	(CFY)	$ 19,762		
Prior Year	(PY)	1,684		
			In-House $	11,856
TOTAL		$ 21,446	Contract $	9,590

Breakdown of Program Areas

1. CHEMICAL WARFARE PROGRAM

a. Defensive Equipment Program	CFY	$ 14,854		
	PY	113		
			In-House $	8,566
TOTAL		$ 14,967	Contract $	6,401
(1) Basic Research	CFY	$ 1,262		
	PY	-0-		
			In-House $	124
TOTAL		$ 1,262	Contract $	1,138

ENCLOSURE 1

(2) Exploratory Development	CFY	$ 4,342			
	PY	-0-			
			In-House	$	3,342
TOTAL		$ 4,342	Contract	$	1,000
(3) Advanced Development	CFY	$ 2,028			
	PY	$ -0-			
			In-House	$	1,116
TOTAL		$ 2,028	Contract	$	912
(4) Engineering Development	CFY	$ 7,222			
	PY	113			
			In-House	$	3,984
TOTAL		$ 7,335	Contract	$	3,351
b. Offensive Equipment Program	CFY	$ 3,285			
	PY	1,571			
			In-House	$	3,290
TOTAL		$ 4,856	Contract	$	1,566
(1) Basic Research	CFY	$ -0-			
	PY	-0-			
			In-House	$	-0-
TOTAL		$ -0-	Contract	$	-0-
(2) Exploratory Development	CFY	$ -0-			
	PY	-0-			
			In-House	$	-0-
TOTAL		$ -0-	Contract	$	-0-
(3) Advanced Development	CFY	$ -0-			
	PY	-0-			
			In-House	$	-0-
TOTAL		$ -0-	Contract	$	-0-

(4) Engineering Development	CFY	$ 3,285		
	PY	1,571		
TOTAL		$ 4,856	In-House $	3,290
			Contract $	1,566
2. BIOLOGICAL DEFENSE RESEARCH PROGRAM				
b. Defensive Equipment Program	CFY	$ 1,623		
	PY	-0-		
TOTAL		$ 1,623	In-House $	-0-
			Contract $	1,623
(1) Biological Defense Research	CFY	$ 1,623		
	PY	-0-		
TOTAL		$ 1,623	In-House $	-0-
			Contract $	1,623
3. ORDNANCE PROGRAM				
	CFY	$ -0-		
	PY	-0-		
TOTAL		$ -0-	In-House $	-0-
			Contract $	-0-

EXPLANATION OF OBLIGATIONS

Chemical Warfare Program

Defensive Equipment Program

Basic Research

This program supported basic research into mechanisms of enhanced chemical decomposition of threat agent and simulants and techniques for remote and selective identification of threat agents at sea. It also supported an understanding of fundamentals of enzymatic catalysis, molecular recognition processes, protein structure and functions applicable to Chemical Biological Warfare Defense (CBWB) areas of decontamination, collective and individual protection and detection. Investigations on photoelectrochemical, electrochemical, and catalytic decomposition of organophosphorus compounds are included as are studies of the behavior of these compounds in electric discharges.

Exploratory Development

Funds supported an examination of the processes that govern behavior under chemical warfare and included an examination of problems in simulating chemical warfare conditions for training purposes; the effects of extreme stress performance conditions on task behavior, and the development of training procedures to increase personnel performance under chemical warfare conditions.

Funds supported the feasibility demonstration and prototyping of an advanced head/eye and respiratory protective clothing ensemble for helicopter and fighter/attack aircrew protection against Chemical Biological (CB) agents. The clothing will be integrated with or supplant standard aircrew equipment and be fully compatible with advanced cockpits and aircraft designs.

Funding supported the independent evaluation of equipment developed by other Services; participation in NBC RDT&E,N efforts conducted by other Services; and conducted research, development testing and evaluation necessary to produce items of NBC equipment unique to the Marine Corps amphibious mission. Specific equipment undergoing evaluation include chemical agent detectors, individual and collective protective equipment, and decontamination systems.

Developed biomedical specification for a new generation of Chemical Warfare (CW) Clothing that will be less performance impairing.

Examined the effects of Chemical Warfare antidotes, pretreatment drugs and therapeutic drugs while primate model is stressed by exercise.

Characterized performance effects of chronic exposures to Chemical Warfare agents and antidote/pretreatment drugs. Information will be used to establish exposure limits for nerve agents, setting detector alarm levels and for establishing decontamination standards.

Evaluated the effectiveness of calcium channel antagonists alone and in combination with standard nerve agent antidotes, in reducing organophosphate toxicity.

Provided technology required for advanced Chemical Biological Defense (CBD) systems that will allow shipboard mission efffectiveness while in a (CB) threat.

Shipboard CB Defense requirements for the development of:

1. Advanced chemicoagent absorbers and decontamination materials and techniques;
2. A CBD Capability assessment methodology and models to specify R&D requirements;
3. Predictive techniques for the interaction of chemical agent with materials;
4. Interior shipboard chemical agent monitors (prior year effort in bio detection); and
5. CBD training technology.

Supported exploratory research seeking to apply enzyme technology to the destruction of organophosphorous nerve agents. The program investigated natural enzymes and the engineering of novel ones using biotechnology.

Advanced Development

Funds supported advanced development for defense of Navy and Marine Corps afloat and ashore against chemical and biological agents. This program included defense of ships, aircraft ground crew protection, overseas shore bases, and interfaces among them. Developments are funded in areas of detection, collective protection, personnel protection, and decontamination.

Engineering Development

Funds supported Operation and Evaluation (OPEVAL) and various in-house testing efforts, Ground Support Equipment (GSE) support, documentation, and system acquisition engineering development support for the Marine Helo Aircrew Chemical Protection (AR-5) Program.

Funds supported mission accomplishment in a hostile Chemical Biological Radiological (CBR) environment by developing equipment and procedures which provide effective CBR Defense. This

program developed protective clothing that minimizes degradation of personnel performance due to heat stress. It is also developing citadel areas for collective protection designed for new ships or backfit in selected compartments plus citadel equipments for ashore facilities. Two basic types of detectors are being developed: long-range, early-warning and point-detectors which locate and identify local/surface contamination. Decontamination processes, substances, and equipment will be provided to remove contamination or detoxify personnel and material. Combination of the products from these four areas provide systems for CBR Defense.

Offensive Equipment Program

Engineering Development

Completed Bigeye Bomb Technical Evaluation including Safe Separation Test Series, Catapult Launch, and Arrested Landing Series, Dissemination Test Series.

Initiated Contract Modification to the Marquardt Company contract to procure 40 additional prototype weapons for Operational Testing of the Bigeye Weapon System. Fifteen weapons are for the Air Force and twenty-five for the Navy.

Conducted Navy Operational Testing (OT-IIA) of the Bigeye Weapon at ranges on the Naval Weapons Center, China Lake, CA, and Dugway Proving Grounds, UT. Shipboard testing and ship suitability testing completed in the Southern California Operating Area.

Conducted chemical tests using actual bomb bodies and chemical reactors at the Chemical Research and Development Center, Edgewood, MD. Test to generate the lethal agent VX were accomplished as well as tests of simulants and mechanical/explosive functioning.

Performed design and coordination of container development and testing for the Shipping Containers.

Conducted engineering and systems support and technical management at the Naval Weapons Center, China Lake, CA.

Supported Joint Service Program for BLU-80/B Weapons.

Biological Research Program

Defensive Equipment Program

Biological Research

Determined feasibility of Deoxyribonucleic Acid (DNA)-Probe technology as a biological agent shipboard detection. Principal Performer: NBL (Navy Biomedical Research Laboratory, Oakland, CA).

A medical defense program of basic research directed at improving the effectiveness of current and future vaccines, developing immunological alternatives to conventional vaccines, and developing stimulants of non-specific immunity and prophylactic and/or therapeutic potential.

ANNEX C

DEPARTMENT OF THE AIR FORCE

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

RCS: DD-USDRE(A) 1065

SECTION I

OBLIGATION REPORT OF

CHEMICAL WARFARE LETHAL AND INCAPACITATING AND DEFENSIVE EQUIPMENT PROGRAMS

FOR THE PERIOD 1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

RCS: DD-USDRE(A) 1065

DEPARTMENT OF THE AIR FORCE

30 SEPTEMBER 1985

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT, TEST AND EVALUATION FUNDS
FOR THE PERIOD 1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985
REPORTING SERVICE: DEPARTMENT OF THE AIR FORCE
DATE OF REPORT: 30 SEPTEMBER 1985
RCS: DD-USDRE(A) 1065

DESCRIPTION OF EFFORT	FUNDS OBLIGATED ($ In Millions)		
RDT&E	PY / CFY	IN HOUSE / CONTRACT	EXPLANATION OF OBLIGATIONS
Offensive RDT&E Program			
Research	.000 / .000	.000 / .000	
Exploratory Development	.000 / 1.626	.000 / 1.626	Initiate development and analysis of improved chemical weapons technology, testing and its methodology that provides desired results within constraints of the open air test plan.-
Advanced Development	.000 / .000	.000 / .000	
Engineering Development	.000 / .000	.000 / .000	
Total Offensive RDT&E	.000 / 1.626	.000 / 1.626	

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT, TEST AND EVALUATION FUNDS
FOR THE PERIOD 1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985
REPORTING SERVICE: DEPARTMENT OF THE AIR FORCE
DATE OF REPORT: 30 SEPTEMBER 1985
RCS: DD-HSDR&(A) 1065

DESCRIPTION OF EFFORT RDT&E	FUNDS OBLIGATED ($ In Millions) PY CFY	IN HOUSE CONTRACT	EXPLANATION OF OBLIGATION
Defensive Equipment Program			
Research	.000 .000	.000 .000	
Exploratory Development	.000 3.188	.082 3.106	
Advanced Development	5.494 3.806	.398 3.408	
Engineering Development	23.866 11.273	1.201 10.072	The program is composed of biological and chemical agent detection, individual protecti collective protection, deconta ination and basic operational medical problems associated wi chemical warfare operation.
Total Defensive (RDT&E)	29.360 18.267	1.681 16.586	

SECTION II

OBLIGATION REPORT ON BIOLOGICAL RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

DEPARTMENT OF THE AIR FORCE

RCS: DD-USDRE(A) 1065

30 SEPTEMBER 1985

NEGATIVE

SECTION III

OBLIGATION REPORT ON ORDNANCE PROGRAM

FOR THE PERIOD 1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

DEPARTMENT OF THE AIR FORCE

RCS: DD-USDRE(A) 1065

30 SEPTEMBER 1985

N E G A T I V E

Nonsystem Advanced Development:

The purpose of this program is to perform the advanced screening of pretreatment and treatment (P&T) compounds against chemical agents and laboratory preparation of selected compounds. Also included in this area are performance decrement studies, guidelines for drug testing and nonsystem application of advanced engineering concepts. Actions in this area contributed to the fielding of products and equipment for the Services.

During FY85:

Developed, standardized, and validated animal models for determining optimal dose of chemical warfare agent pretreatment/therapy compounds.

Completed toxicity studies and microencapsulation on cyanide antidotes.

Developed a standardized test for organophosphate toxicity in cell culture.

Completed a performance assessment battery on the pretreatment drug, pyridostigmine.

Found that when using a laser-guided weapon system, atropine (4 milligrams) impaired the tracking performance.

c. **Full Scale Development**

(1) **Decontamination Concepts and Materials**

Decontaminating Apparatus, Diesel Powered, Skid Mounted, XM18:

This apparatus will be used for the decontamination of equipment, personnel, and to a limited extent, terrain. It will also serve as a water pumper, firefighter and mobile bathing unit. It will use diesel engine power and will be skid mounted. Essentially, it will consist of three components: a stainless steel storage tank (approximately 450 gallons), a hybrid steam generator/water heater, and a 50 to 90 gallon-per-minute main pump unit.

During FY85:

Fabricated and tested four systems. Test results identified areas which require improvement.

Initiated changes to improve both hardware and technical manuals.

Began fabrication of the seven remaining Development Testing/Operational Testing II (DT/OT II) systems.

Decided to adopt a Lightweight Decontaminating Apparatus as part of this development system in lieu of a large development steam cleaner.

Decontamination Kit, Individual Equipment, XM280 (DKIE):

The objective is to develop a decontamination kit for a soldier's personal equipment. This kit will decontaminate masks/hoods, protective gloves, footwear, weapons, helmets, and load-bearing equipment to preclude agent transfer during doffing of the chemical biological protective ensemble.

The DKIE will consist of a container less than one cubic foot in size and weigh less than 60 pounds. It will contain twenty individual packages. Each package will contain two foil packed decontaminant impregnated towelettes. The individual package will be small and rugged enough to be carried in the trouser pocket of the Battledress Overgarment.

During FY85:

Adopted the M280 for Army use as a result of an accelerated effort nine (9) month intensive effort.

Awarded a development contract to Mine Safety Appliances who prepared a technical data package and fabricated items for testing.

Approved a System Concept Paper/Acquisition Strategy.

Prepared an initial production contract with award expected 2QFY86.

Lightweight Decontamination System, XM17:

The XM17 is a portable lightweight (350-pound) decontaminating system which will decontaminate equipment and patients. It is a water heating unit designed to draw water from any source and deliver it at controlled temperatures up to 120° and pressures up to 100 psig. This unit is supplemented by a 145-pound kit containing hoses, cleaning jets, personnel shower hardware and a collapsible water tank with a capacity of 1580 US gallons.

During FY85:

Completed the Initial Production Testing.

Decided at the Special In-Process Review to field the FY84 quantity and proceed with the FY85 and FY86 quantities.

(2) Collective Protection Systems

Modular Collective Protection Equipment (MCPE):

The modular collective protection equipment consists of a family of end items: three different sized filter units, four protective entrances and a static frequency converter. MCPE provides nuclear, biological, and chemical protection by providing filtered air under positive pressure to vans, vehicles, and shelters to prevent the infiltration of toxic chemicals, biological agents, and radioactive particles. A collapsible protective entrance which is pressurized in the same manner provides entry/exit capabilities for these vans, vehicles, and shelters. Pressurization is provided by the filter units and is automatically maintained. Generally, the basic units are installed outside the protected area while the controls are located inside.

During FY85:

Initiated additional design applications for MCPE for the Improved Air Defense Missle (HAWK), Tacticle Management Information System (TAC-MIS-DA53) and Surveillance Target Attack Radar System (JOINT STARS).

Awarded seven (7) contracts for MCPE to support various programs such as JOINT STARS, HAWK, and TRAIL BLAZER.

Completed the Full Scale Development Test Program.

Completed additional fieldings of MCPE with Tactical Fire Direction System (TACFIRE) '5 Systems) in Germany.

Convened a Special Technical Review. Agreed to continue the development of the 100 cfm filter unit, the variable speed control system for the 200 and 400 cfm filter units, the integral protective entrances for the S250 and S280 shelters, and the push through dust separator for the 200 cfm filter unit.

Initiated an effort to develop a cooling shroud for the XM5 Static Frequency Converter for suitability retests.

Pre-Planned Product Improvement (P^3I):

Continued P^3I effort for fixed installation filters.

(3) Warning and Detection Equipment

Simulator, Detector Unit, Chemical Agent, Automatic Alarm, XM81:

The XM81 is a training device for use with M8 automatic chemical agent alarm. It will be remotely activated by a handheld battery-operated radio transmitter. The device will be capable of being selectively activated to simulate agent cloud travel during field training exercises. It will use normal field procedures for the M8 alarm system and will be sturdy enough for field operations.

During FY85:

Conducted Development Acceptance In-Process Review and the XM81 was type classified standard.

Awarded the first buy.

Chemical Agent Monitor (CAM)

The objective is to conduct an International Materiel Evaluation (IME) of the UK developed CAM to achieve early fielding (FY87) of a contamination monitor. The monitor

will detect, locate, and identify chemical agent vapor contamination emanating from equipment, personnel, and surfaces. The CAM detection principle is based on ion mobility spectrometry. Microprocessor techniques are used to detect, identify, and indicate the relative amount of contamination and reject interferences.

During FY85:

Completed Phase II of the International Materiel Evaluation.

Held a Milestone II In-Process Review. Limited production (LP) type classification with subsequent sole source contract to the United Kingdom contractor, Graseby Dynamics, Ltd. was approved.

(4) Individual Protection Equipment

Mask, Chemical and Biological, Multipurpose, XM40:

The XM 40 will provide protection for the face, eyes, and respiratory tract against field concentrations of chemical and biological agents in vapor or aerosol form, toxins, infrared screening smokes, radioactive fallout particles and combinations thereof. This mask will fit better and provide improved protection. It will have an easily replaceable filter. It will replace the M17 field protective mask, the M24 aircraft mask, the M25A1 combat vehicle mask, the M9A1 Special Purpose Mask, and the Navy Mark V Mask.

During FY85:

Conducted DT II/OT II tests on each of the three candidate protective masks, namely, two versions of the U.S. developed XM40's along with a British developed US-10 respirator. Tests were conducted at five DT II test sites and four OT II test sites. Each mask performed exceptionally well. Final test reports have been published.

Pre-planned Product Improvement (P^3I)

Continued headharness P^3I effort for the M17 Series Mask.

Tactile Glove (TG)

The development of a tactile protective glove is meant to replace the standard chemical protective glove for tasks which require a high level of tactility and dexterity.

During FY85:

Completed evaluation and adopted the 7 and 14 mil butyl gloves as the interim Tactile Glove (TG).

Began evaluation of the epichlorohydrin (ECO)/butyl rubber gloves.

Continued evaluation of several improved glove liners.

Aircrew Uniform Integrated Battlefield (AUIB):

The AUIB is designed to provide chemical and flame protection in one uniform. In addition, the AUIB is being designed to interface with microclimate conditioning equipment.

During FY85:

Selected final design and material for the AUIB.

Awarded a contract to procure materials.

Graded and cut final patterns for all sizes of the AUIB.

Suit Contamination Avoidance and Liquid Protective (SCALP):

The SCALP will provide a barrier to liquid chemical agent when worn over the chemical protective ensemble (CPE). The SCALP will prevent liquid agent contamination of CPE during short-term operations outside collectively protected systems.

During FY85:

Initiated development of item design concepts.

Procured and began the evaluation of candidate materials.

XM43 Aircrew Chemical Biological (CB) Protective Mask:

The objective of this program is to design and develop a CB mask that will provide the required CB protection to crewmembers of the AH-64 and be compatible with the Integrated Helmet and Display Sighting System (IHADSS).

During FY85:

Fabricated and delivered a total of two-hundred and fifty masks and one-hundred and twenty-five motor/blower assemblies to DT II/OT II test sites.

Initiated DT II/OT II testing.

(5) Medical Chemical Defense Life Support Material:

The purpose of this program is to: establish efficacy and dosage regimen of final drug formulations; compile clinical data and supporting documentation for new drug application to the Food and Drug Administration for licensure of pharmaceutical products; complete final testing of drug products and components used to administer drugs; and validate large scale producibility of pharmaceuticals.

During FY85:

Validated the product process and began the initial production of the blood agent antidote for use at the battalion aid station.

Tested, with agent, seven (7) materials for use in the chemical agent patient protective wrap. Conducted developmental testing of the wrap to determine heat and carbon dioxide build-up characteristics.

d. Testing

(1) Materiel Test in Support of Joint Operational Plans and/or Service Requirements:

No obligations were incurred.

(2) Army Material Suitability Tests

No obligations were incurred.

5. TRAINING SUPPORT

a. Training

No obligations were incurred.

6. SIMULANT TEST SUPPORT

Efforts were directed toward planning, conducting, and reporting on joint tests and operational research studies performed to meet the requirement of the Commander-In-Chief of the Unified and Specified Commands. These tests and studies provide useful data on chemical systems and chemical/biological defense materials for the user.

During FY85:

Simulant Review Selection: Continued effort to develop nontoxic materials for use as agent simulants.

Performance Degradation in a Contaminated Environment: Evaluated eight (8) Marine Corps exercises involving armor, signal, missile and night reconnaissance units.

Aircraft Operations - Toxic Environment: Completed tests to determine the hazards of a toxic milieu to aircraft operations on the ground and aloft after a chemical attack.

Quick Response/Planning Digest: Continued to provide quick responses (e.g. literature searches) to inquiries from the Department of Defense.

Medical Battalion Support in Amphibious Operations: Completed a study of the battalion support required following a chemical attack.

Impact of Dust Storms: Completed a study on whether chemical agents transported by fine dust particles present a hazard to personnel.

Chemical Defense Operations in Extreme Cold: Completed a study of the special problems of chemical defense operations in extreme cold conditions.

Maintenance Operations in a Chemically Contaminated Environment: Conducted tests to determine the performance of maintenance personnel while wearing chemical protective clothing and masks.

Aqueous Film Forming Foam: Conducted tests to determine if this firefighting material can be used as an effective decontaminant for chemical agents.

Effectiveness of Chemical Bombs: Completed a study to determine the effectiveness of chemical bombs delivered by jet aircraft against selected targets.

Protection Provided by Buildings: Completed a study on how ordinary buildings, with and without airconditioning, protect the inhabitants from chemical agents.

Decontamination Summary: Continued a study designed to answer a variety of interrelated questions about techniques for chemical agent decontamination.

Detection, Alarm, and Soldier Interface: Completed a study to determine the efficiency of this man-machine interface.

Electronic Equipment Decontamination: Completed a survey of on-going efforts in industry and Department of Defense to decontaminate electronic equipment contaminated by chemical agents. Follow on laboratory testing is scheduled for FY86.

Evaluation of Spray Delivery: Initiated a study to determine if new delivery tactics are needed to ensure aircraft survivability in a high intensity anti-aircraft defensive area.

Effects of Chemical Attack on Unconventional Military Operations (UMO): Initiated a study of the unique problems confronting units engaged in UMO when forced to operate in a contaminated environment.

Effects of Construction Operations on Protective Equipment: Initiated a study to determine whether the protective equipment worn by engineers during construction operations will be compromised by dust, diesel exhausts, abrasion, tears, etc.

Tactical Aeromedical Evacuation in a Chemical Environment: Evaluated the tactical aeromedical evacuation system (TAES) to determine if it can be successfully used both in and out of chemically contaminated areas. A report will be published in early FY86.

Decon Effects on Individual Items of Equipment: Conducted laboratory tests to determine if personal equipment (such as rifles, load bearing equipment, helmet covers, etc.) can be decontaminated and if so, how many times?

SECTION II

OBLIGATION REPORT ON BIOLOGICAL DEFENSE RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

DESCRIPTION OF RDTE EFFORT FOR THE BIOLOGICAL DEFENSE RESEARCH PROGRAM

During FY85, the Department of the Army obligated $66,905,000 for biological research investigations and the development and test of physical and medical defensive systems.

FUNDS OBLIGATED

Current Fiscal Year (CFY)		$ 37,570,000	
Prior Year (PY)		29,335,000	
TOTAL		$ 66,905,000	In-House $36,394,000 Contract $30,511,000

Breakdown of Program Areas

1. **BIOLOGICAL DEFENSE RESEARCH**

a. Basic Research on Life Sciences	CFY	$ 274,000	
	PY	-0-	
		$ 274,000	In-House $ 249,000 Contract $ 25,000
b. Medical Defense Against Biological Warfare	CFY	$ 7,034,000	
	PY	6,631,000	
		$ 13,665,000	In-House $ 7,984,000 Contract $ 5,681,000
TOTAL: BIOLOGICAL DEFENSE RESEARCH	CFY	$ 7,308,000	
	PY	6,631,000	
		$ 13,939,000	In-House $ 8,233,300 Contract $ 5,706,000

2. DEFENSE SYSTEMS			
a. Exploratory Development	CFY PY	$ 11,747,000 10,553,000	
		$ 22,300,000	In-House $16,107,000 Contract $ 6,193,000
b. Advanced Development	CFY PY	$ 14,098,000 9,613,000	
		$ 23,711,000	In-House $11,017,000 Contract $12,694,000
c. Full Scale Development	CFY PY	$ 4,417,000 2,538,000	
		$ 6,955,000	In-House $ 1,037,000 Contract $ 5,918,000
d. Testing		-0-	
TOTAL: DEFENSIVE SYSTEMS	CFY PY	$ 30,262,000 22,704,000	
		$ 52,966,000	In-House $28,161,000 Contract $24,805,000
3. SIMULANT TEST SUPPORT		-0-	
4. MANAGEMENT AND SUPPORT		-0-	

1. BIOLOGICAL DEFENSE RESEARCH

a. Basic Research in Life Sciences

The objective of this program is to support the Biological Defense Program and to maintain a technology base for non-medical aspects of biological defense. Effort is also directed toward the appraisal of new concepts for the rapid detection, identification, and decontamination of biological threat agents.

During FY85:

Developed analytical techniques to measure mycotoxin penetration through military materials and structures. Determined the resistance to mycotoxin penetration of selected protective materials. Investigated toxin interactions with the materials during single and multiple toxin challenge.

Continued to develop procedures for assaying low levels of bacterial toxins. Determined the stability of Biological Warfare (BW) agents exposed to diverse environmental conditions and studied methods for detoxification of BW agents. Completed studies on the stability and decontamination of staphyloccal entertoxin A.

b. Medical Defense Against Biological Warfare

Basic Research

This area is being developed to provide the science base information for the advancement of improved systems for the medical diagnosis, treatment, and prevention of BW casualties on a BW battlefield.

The objectives in this area are: To determine the physio-chemical nature of militarily important bacterial toxins and how they enter the cells and cause their destruction; to develop a scientific base to counteract medically the threat posed by new or existing bacteria and rickettsiae; and to evaluate the newly discovered viruses as BW agents or as natural threats in certain geographical areas. These lethal but little understood viruses must be studied in the laboratory where strict containment techniques can be enforced.

The Soviet supported use of the deadly trichothescene toxins in Indochina prompted an extensive research program on the medical defense against mycotoxins such as T-2 and marine toxins.

During FY85:

Prepared six (6) immunologically cross reacting materials (CRM) and one has been evaluated for its potential as a vaccine to protect against botulinum toxin, Type B.

Discovered a cofactor binding site on the heavy chain of botulinum toxins A, B, and C using photo affinity label technology. The cofactors which bind are biologically relevant molecules found in nerves and may be a clue as to how these toxins inhibit the release of neutrotransmitters. The cofactor binding site could be the point at which to intervene with drug therapy to counteract the adverse effects of the toxins.

Used a mouse aerosol model to assess comparative toxicity of the trichothecenes, time-related distribution of T-2 toxin, and the toxin-induced hemostatic derangement. T-2 aerosols generated from dry powder caused exposed mice to develop a dry inflamation of the conjunctiva, nose, sinuses, and lips. These symptoms were not observed in animals exposed to other forms of T-2 aerosols.

Tested spontaneous non-capsulated (C-) variants from 14 strains of B. anthracis to study their usefulness as live, attenuated vaccine candidates. Some of the (C-) isolates from 3 strains reverted to the virulent, capsulated (C+) form at frequencies ranging from 0.12 to 3.0%. Variants from Sterne, SII and SK66 strains did not revert to (C+) and remain as viable vaccine candidates requiring extensive additional study.

Discovered a proteinaceous component that may be the key antigen in providing protection to Q fever. This component is identified by its molecular weight of 29.5K daltons and was found in the Rickettsial envelope.

Cloned and sequenced the entire M segment of ribonucleric acid (RNA) of Rift Valley Fever Virus (RVFV). This RNA was shown to code for both envelope glycoproteins of RVFV. Polyclonal antisera prepared against purified G1 glycoprotein exhibited a higher

neutralizing activity than G-2; however, neutralizing monoclonal antibodies to G-2 were more abundant. It now appears that the G-2 fraction is more important in providing protective immunity than the G-1 fraction.

2. DEFENSIVE SYSTEMS

a. Exploratory Development

The objectives of this program are to assess aerosols of microbial organisms or their toxins to determine their potential as biological warfare (BW) threats and develop medical countermeasures; to develop safe vaccines/toxoids for agents and toxoids that are significant BW threats; to develop effective antiviral drugs; to develop technology to identify a BW agent within six hours or before classic disease symptoms appear; and to perform a risk assessment and evaluation of viral agents and their vectors that pose a potential BW threat.

During FY85:

Showed that live attenuated Junin vaccine protects guinea pigs against virulent virus aerosol challenge. Tickborne encephalitis virus vaccine and Rift Valley Fever (FVF) vaccine failed to protect vaccinated experimental animals against aerosol challenge.

Discovered that mice vaccinated sub-cutaneously (SC) with killed RVF vaccine plus aviridine were protected against both aerosol and SC challenge. It must be duplicated before it can be concluded that killed vaccines against aerosol challenge may be enhanced with adjuvants such as aviridine.

Discovered that the current anthrax vaccine, consisting of protective antigen (PA) protected guinea pigs challenged by intramuscular injection of 1000 virulent spores of vollum strain; however, it didn't when challenged with virulent spores from nine (9) heterologous strains. The veterinary vaccine, an attenuated Sterne spore vaccine, protected guinea pigs against all virulent strains of anthrax test. This vaccine provided good protection against aerosol challenge.

Found that the response of the guinea pig, currently used to assess anthrax vaccines, is quite variable. Inbred mice were found to be uniquely susceptible to infection by the Sterne strain of B. anthracis. Mice may replace the guinea pig as the model of choice.

Undertook comprehensive laboratory studies to determine the underlying pathogenic mechanism(s) active in filovirus infections.

Examined, antigenic relationships among nine (9) hemorrhagic fever with renal syndrome (HFRS) - related isolates by solid-phase radioimmune assays (RIA) and plaque-reduction neutralization tests (PRNT) utilizing antisera produced by experimental infection of Wister rats. The data indicated that each of the isolates was antigenically unique, yet exhibited a pattern of cross-reactivity which seemed to correlate with lost factors rather than geographic location.

Refined an Enzyme-Linked Immunosorbent Assay (ELISA) technique for T-2 detection that eliminates past difficulties of non-reproducibility. A radioimmunoassay was developed that is able to detect diacetoxy scirpenol (DAS) at about 10 NG/ML. It is now possible to detect T-2 and DAS toxins simultaneously and without interference. These data confirm that it will be possible to detect multiple trichothecenes with the use of appropriate antisera.

Found that 3,4 Diaminopyridine efficacy against botulinal intoxication is short-lived in mice. Therapeutic studies with this drug are being dropped.

Produced and partially purified by open column liquid chromatography 400 liters of equine antitoxin. The toxin neutralizing titers were determined to be equal to or greater than those found in the products available from the Centers for Disease Control (CDC). This experimental antitoxin also had neutralizing antibodies to Type G toxin and is; therefore, unique.

Discovered that binary combinations improve efficacy of antiviral compounds. The combination of alpha and gamma interferon as well as beta and gamma interferon demonstrated synergistic efficacy against Yellow Fever, Venezuelan Equine Encephalomylitis (VEE), RVF and Japanese B Encephalitis infections. Ribavirin and the immune modulator, poly-ICLC, was determined as effective antiviral drugs.

Found several drugs to be quite promising in treating T-2 intoxication. The most practical is oral charcoal which can substantially reduce the mortality of a single lethal dose (LD). Glutathione prodrugs as well as glucocorticoids, antioxidants, and microsomal inducing agents have also been effective.

b. Advanced Development (non Systems)

The objectives of this program are to scale up laboratory processes for vaccine preparation into pilot operations; to purchase larger quantities of antiviral drugs for further testing and evaluation; and to develop industrial base operations for rapid identification and diagnosis of BW threat agents.

During FY85:

Evaluated live-attenuated Chikungunya (CHIK) vaccine for avirulence and immunogenicity in rhesus monkeys. Conducted a 2 ½ month, sixteen (16) monkey immunization-challenge study employing varying doses of Clone 25. All immunized monkeys demonstrated: (1) low or undetectable viremias; (2) significant neutralizing titers; (3) 100% protection against challenge with virulent chik virus measured by diminished or undetectable viremias; and , (4) no side effects or clinical signs.

Prepared and evaluated an experimental formalin-inactivated CHIK vaccine employing Clone 25. Preliminary results demonstratd the high immunogenicity of this vaccine. Further study of killed CHIK vaccine is required. It may fill the same type of limited need as the C-84 killed Venezuelan Equine Encephalomyelitis (VEE) vaccine.

Developed an improved culture medium for growing vaccine quantities of the three important anthrax antigens; e.g. protective antigen, lethal factor and edema factor. Developed a new tangential flow filtration procedure to harvest laboratory quantities of anthrax cultures. This procedure is being used because it is safer, faster, and because there is no significant difference in spore recovery.

Serially passed clones from two virulent Rift Valley Fever (RVF) virus strains in MRC5 cells in the presence of a mutagen and compared them to passages carried out in a conventional fashion in the same cell line. One clone was significantly attenuated and loss of virulence was progressive. The other clone failed to show attenuation even after 16 mutagenesis cycles. The attenuated product of 12 mutagenization cycles was chosen for further study. This is a potential important technique and useful strain.

Developed rapid assays for the detection of antigen in clinical or environmental samples for: RVF, Sandfly Fever Sicilian (SFS), Venezuelan Equine Encephalomeyelitis

(VEE). Crimean-Congo Hemorrhagic Fever (CCHF), West Nile (WN), Chikungunya (CHIK), and Sindbis (SIN) Viruses. Simplified assays, to detect immunoglobulin M (IGM) antibodies, were developed for some of these viruses. Optimization of each assay has been accomplished, and production of appropriate reagents in sufficient volume for preliminary field testing is in progress.

Developed rapid diagnostic tests for anthrax which included the establishment of Enzyme-Linked Immunosorbent Assay (ELISA) methods to determine antibody titers to B. Anthracis capsule, fluorescent antibody staining of capsule, production of monoclonal activity for vegetative cells, and characterization of twelve monoclones to spores and three to vegetative cells.

Found that Botulinum Type A neurotoxin preparations, collected during varying stages of toxin purification and toxoided by formalin treatment, were non-toxic when tested for toxicity in mice and guinea pigs. Their immuogenic strengths were compared with a known immunogenic monovalent botulinum type A toxoid. It was found that the purer preparation had the highest neutralizing antibodies.

Developed an ELISA method for determination of saxitoxin that is rapid and capable of detecting 100 nanograms (NG) of toxin per millimeter (ML). The ELISA was able to handle large numbers of samples (200/day). The assay was also used to screen supernatants for anti-saxitoxin antibodies and thirty-three (33) positive samples were identified.

Drug and Vaccine Development:

Advanced Development (Systems)

The objectives of this program are to scale up laboratory processes for specific vaccine preparation to industrial scale; to prepare pilot quantities of specific vaccines for testing, for administration to "at risk" workers and storing moderate quantities for use in emergencies; to document vaccine scale-up procedures from laboratory to industrial scale; to establish industrial base operations for rapid identification and diagnosis of specific biological warfare threat agents; and to establish industrial base operations for therapeutic and prophylactic products for man against natural infections of military importance and potential BW agents. These pharmaceuticals are being produced in accordance with Good Manufacturing Practices (GMP) as established by the Food and Drug Administration (FDA).

During FY85:

Tested the drug ribavirin against sandfly fever virus. Illness was prevented in all individuals receiving ribavirin, while most placebo-treated control subjects became ill.

Performed studies in Africa in the prevention of naturally occurring Lassa Fever using ribavirin in conjunction with specific Lassa Fever virus antibody. The human sera containing Lassa antibody were collected in Liberia and Sierra Leone.

Screened approximately 200 antiviral drugs for their effectiveness against Japanese B Encephalitis, Rift Valley Fever, Venezuelan Equine Encephalomyelitis, Pichinde, Vesicular Stomatitis, Sandfly Fever, Korean Hemorrhagic Fever and Yellow Fever viruses.

Prepared reagents and spot slides for rapid diagnosis of Hantaan and Puumula viruses.

Conducted extensive studies to stabilize the live, attenuated Argentine Hemorrhagic Fever virus vaccine.

Grew certified cell substrates for the production of human vaccines.

Tested stored vaccines on a predetermined schedule to assure the continuing potency of the products.

Prepared solicitation and selected contractors to prepare vaccines for anthrax and a polyvalent botulinal toxoid.

Tested prototype test kits from nine contractors on the biological agent identification and diagnostic system, rapid, field project.

c. Full Scale Development:

The objectives of this program are: (1) to standardize a production process for a specific vaccine or drug that will produce sufficient quantities necessary to perform phase II and phase III clinical trials. If these trials are successful, then 2,000,000 doses of the vaccine or drug will be produced for US forces; and (2) to standardize a production process for a specific system for the rapid diagnosis of BW agents.

During FY85:

Produced three million doses of tularemia vaccine.

Produced chloroform-methanol residue bulk antigen for Q fever which should provide about 50,000 doses of final vaccine.

Produced one freeze-dried and bottled research quantity of the live, attentuated Argentine Hemorrhagic Fever.

Produced several lots of inactivated Rift Valley Fever vaccine and conducted safety tests on these lots.

Completed a production run of Chikungunya vaccine.

d. Testing

No obligations were incurred.

3. SIMULANT TEST SUPPORT

No obligations were incurred.

4. MANAGEMENT AND SUPPORT

No obligations were incurred.

SECTION III

OBLIGATION REPORT ON ORDANCE PROGRAM

FOR THE PERIOD 1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

DESCRIPTION OF RDTE EFFORT FOR THE ORDNANCE PROGRAM

During FY85, the Department of the Army obligated $18,314,000 for general research investigations, development and test of smoke, riot control agents and weapons systems.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$ 18,314,000
Prior Year (PY)	-0-
TOTAL	$ 18,314,000

In-House $11,787,000
Contract $ 6,527,000

Breakdown of Program Areas

Smoke Program	$ 16,150,000
Riot Control Program	-0-
Test Support	$ 2,164,000

DESCRIPTION OF PAA EFFORT FOR THE ORDANCE PROGRAM

During FY85, the Department of the Army obligated $75,811,000 for procurement of smoke/obscurants, riot control agents, weapons systems and other support equipment.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$ 33,953,000	
Prior Year (PY)	41,858,000	
TOTAL	$ 75,811,000	In-House $ 59,977,000 Contract $ 15,834,000

Breakdown of Program Areas

Smoke/Obscurants Program	$ 70,310,000
Riot Control Program	$ 1,056,000
Other Support Equipment	$ 4,445,000

Developed a new and improved through-mask feeding valve and food storage/transfer system to deliver liquid, paste and solid stick foods through the mask.

Developed three fabric heaters to be used by crewmen for heating through-mask feeding meal components and meals consumed by soldiers in remote collective protection.

Initiated development of a laundry, dry cleaning decontamination system. A commercial freon dry cleaning unit was procured and a contract for a breadboard prototype trailer-mounted dry cleaning unit was awarded.

Continued development of a data base on the relative penetrabilities of protective clothing systems and developmental materials to a biological warfare simulant, Bacillus globigii (Bacillus subtilus var. Niger) spores. A test apparatus was designed and built to evaluate the penetration of fabrics by spores. Over 20 materials were evaluated in the apparatus, including permeable, semi-permeable, and impermeable fabrics or films.

Collective Protection

The objectives of this program are to evolve concepts for collective protection against present and future threat agents for joint service application; and to develop and maintain a technical base on the mechanisms of protection against chemical and biological agents.

During FY85:

Conducted climate chamber evaluations of various chemical warfare (CW) tents to gain data to support programs to replace the M51 shelters and to develop CW hardened general purpose tentage.

Completed the evaluation of the tentage barrier concepts.

Produced and evaluated a prototype chemical warfare tent made with a new 7oz/yd^2 polyester fabric/Tedlar film/Kevlar fabric. A contract for a less costly version of this fabric (replacing Kevlar with a polyester fabric) was awarded.

Completed the scope of work for the fabrication of two prototype Battalion Aid Stations (BAS).

Evaluated Hardened Tent, Extendable, Modular, Personnel (TEMPER) concepts.

Awarded a contract for the design of a spray decontamination chamber and for testing the performance of material absorption/desorption.

Initiated live agent testing of an Extendable International Standardization Organization (ISO)* Shelter entrance designed by Tactical Equipment Corporation.

Awarded contracts for BAS fabrication of both the pressurized rib and metal frame designs for concept comparison studies.

Tested two different concepts of a regenerative filter system for use with the Advanced Collective Protection Equipment (ACPE).

Continued the investigation of electrical discharge plasma with emphasis on alternating current (AC) Corona plasma for detoxification of chemical agents in air streams.

Initiated efforts to develop a low temperature catalyst for air purification based on catalytic oxidation technology.

Conducted studies to eliminate the use of chromium, a hazardous material, from current military adsorbent (ASC Carbon). Molybdenum and vanadium were identified as possible alternatives.

Initiated a study to identify adsorbents with improved regenerability over that of carbon.

Achieved significant progress in the technology of adsorption of more than one chemical vapor by ASC Carbon.

* ISO - This is a designation for International Organization of Standardization.

Completed testing of the Interim Aircrew Ensemble. The system is currently being procured to provide an immediate capability.

Received materials for evaluation from a contract to combine the protective properties of the M-3 Toxicological Agents Protective Coveralls and the Rocket Fuel Handler's Coveralls. The material choice will affect end item design and construction.

Began testing seven (7) versions of the Enhanced Chemical Protective Suit (ECPS). The ECPS will replace the Battledress Overgarment as the standard chemical protective suit.

Continued development of a device or process to be used in conjunction with the canteen that will provide the individual soldier with the capability of purifying chemically contaminated water in the field. Selected a commercially available portable compressed carbon cartridge with hand pump. Based on Prototype I testing results, a rugged prototype II design having double the filtering capacity with a built in pump is presently under development.

Continued development of Advance Techniques for Small Group Water Purification for Special Forces requirements. Techniques for desalinating brackish or seawater can also remove chemical and biological agents from contaminated salt water. Distillation and reverse osmosis techniques were evaluated for their ability to both desalinate salt water and remove contaminants.

Continued development of a lightweight, man-packed, microclimate conditioning system for individual ground soldiers.

Developed instrumental methodology for monitoring the distribution of activated carbon in the carbon impregnated foams used in chemical protective battlefield uniforms.

Awarded a contract for chemical agent surrogate testing to determine the effects of decontamination procedures on modified food packages, food packages/systems, and commissary fixtures.

Successfully conducted field tests of electrolyte beverages designed to nourish masked troops; successfully completed the two year storage/stability study; and developed an additional flavor (orange).

Field-demonstrated advanced through-mask feeding concepts.

Made considerable progress in the study of the mechanisms involved in the destruction of chemical agents by electric discharge plasmas and catalytic oxidation reactions.

Completed the testing and analysis of entry-exit procedures for the M1A1 Tank. Found that the use of a low cost, flexible hatch cover can significantly reduce vapor contamination during personnel entry/exit and rearm operations.

(2) Warning and Detection Investigations

Reconnaissance, Detection, and Identification

The objectives of this program are to evolve new and improved concepts, methods, and materials for point detection, identification and warning for all chemical and biological agents for joint service applications; to develop concepts for product improvement programs to upgrade standard chemical and biological agent point detectors; and to update and maintain a Reconnaissance Detection and Identification (RDI) Master Plan.

During FY85:

Fabricated a breadboard Miniature Electro Chemical Detector (MECD).

Determined the feasibility of pattern recognition for detection of chemical agents under ambient conditions using piezoelectric and surface accoustic wave (SAW) devices.

Initiated development of a microelectronic pathogen sensor as a joint Chemical Research and Development Center/Defense Advanced Research Project Agency effort.

Selected a final concept for a fieldable immunochemical test to detect T-2 toxin in water.

Prepared monoclonal antibodies for nerve agents GB and VX and T-2 metabolites. Also, synthesized an immunogen for mustard (HD).

Demonstrated a laboratory based functional receptor assay for nerve agents, mustard, cyanide and a variety of neurotoxins.

Evaluated the breadboard (IR) infrared Laser Standoff Detector. Performance results were outstanding.

Initiated efforts to establish the feasibility of biological standoff detection using Laser Induced Fluororescent (LIF) and Circular Intensity Differential Scatter (CIDS).

Completed field testing to define approach for a Nuclear Biological Chemical Aerial Reconnaissance and Aircraft Detection System using point detectors.

Performed demonstration of a satellite based communication system for drop-off chemical agent detectors.

(3) Medical Defense Against Chemical Agents

The purpose of this program is to perform the exploratory development of selected technologies and methodologies to minimize vulnerability and maximize the survivability of soldiers and patients on the battlefield. These technologies include advanced engineering practices, testing of selected chemical warfare protective products, pharmacology and toxicology of protective drugs, and laboratory preparation of research quantities of test drugs for initial drug screening. Specifically, the objectives are to conduct research to define drug/agent interactions and preliminary decontamination studies.

During FY85

Discovered that nontoxin Soman analog pretreatment reduced effects of Soman on rats.

Determined the amino acid sequence of human serum acetylcholinesterase.

Found that chronic intake of pyridostigmine in drinking water did not affect endurance capability and thermoregulation in rats.

Discovered that anti-cholinesterase-induced seizures have both muscarinic cholinergic and noncholinergic components.

Determined, after a single dose of Soman, the long-term reduction of regional brain acetylcholinesterase.

Demonstrated the potential of modified clay as a skin decontamination.

Demonstrated the feasibility of detecting nerve agents using topical enzymes.

Found that resuscitation (cricothyroid cannula plus high frequency jet ventilation) and atropine was effective against a dose of 2XLD50 (lethal dose) of Soman in anesthetized baboons.

Identified long-term behavioral changes in rats following a dose of 2XLD50 dose of Soman. Changes in optical quality resulted from corneal exposure to Soman.

Found that sublethal doses of nerve agents induced performance changes in rodents which disappear within twenty-four hours.

b. Advanced Development

(1) Chemical Decontaminating Material

Decontaminating Apparatus, Interior Surface, XM15

This apparatus is being developed to decontaminate chemical and biological warfare agents from the interior surfaces of combat vehicles, shelters, water crafts, electronic equipment, vans, and aircrafts. It will be small, carried on board and used by the crew. It will reduce the contamination to such levels that the personnel may remove the protective mask and the rubber gloves or unbutton the protective overgarment.

During FY85:

Prepared an Acquisition Strategy, an Acquisition Plan, and a Procurement Request Package.

Recommended during a joint Chemical Research and Development Center (CRDC) and USACMLS meeting that the XM15 program be terminated.

Examined existing development items for interior surface decontamination potential.

Non-Aqueous Equipment Decontamination System (NAEDS)

This system is being developed to decontaminate small items of equipment, avionics, communication, electronic and optical equipment, personal equipment, and weapons. Two versions will be fielded: an interim item for use at fixed sites only and a mobile, fully militarized item which will be trailer mounted for use anywhere on the battlefield.

During FY85

Completed an Initial Systems Analysis.

Prepared a Procurement Request Package for the Advanced Development of the NAEDS.

Initiated a Producibility Engineering and Planning Study and an Integrated Logistics Support Plan.

Coordinated and delivered an Acquisition Plan.

Non-Aqueous Vehicle Decon System (NAVDS)

This system is being developed to provide an operational capability to perform nonaqueous decontamination of large equipment and vehicles/aircraft exposed to Nuclear Biological Chemical contamination. The intent of the proposed system is to eliminate the present dependency of decon operations on water, to reduce the resource requirements of current systems, and to increase the rate at which decontamination is effected. The system will also have the secondary capabilty of producing smoke.

During FY85:

Performed market surveys to determine what technology should be used in the NAVDS.

Prepared a Trade-Off-Determination, Trade-Off Analysis and Best-Technical-Approach (BTA).

Identified a jet exhaust gas physical removal decontamination system as the BTA.

Initiated an Acquisition Strategy, Acquisition Plan and a Procurement Request Package.

(2) Collective Protection Concepts

Collective Protection Equipment: NBC Simplified, XM20:

The XM20 is designed to convert a room of an existing structure into a positive pressure collective protection chemical biological shelter for ten men. This system will permit the personnel to work without the impediments of overgarment and mask.

During FY85:

Successfully completed Development Testing (DTI) and Operational Testing (OTI).

Recommended Type Classification upon approval of the Basis of Issue Plan.

Drafted the Acquisition Strategy, Acquisition Plan, and Test and Evaluation Master Plan for development of the XM20 Pre-planned Product Improvement.

Multipurpose Overboot (MULO)

The MULO is to replace the current chemical protective footwear cover and the wet weather overshoe by combining the salient characteristics of each boot into a single item. Flame resistance, decontaminability and resistance to petroleum oils and lubricants are to be considered in designing MULO.

During FY85:

Chose the German and Canadian overshoe under the International Materiel Evaluation (IME), and the modified U.S. vinyl overshoe as MULO candidates.

Began the arctic and tropics wear tests of the MULO IME.

Received preliminary design concepts from the contractor for MULO development.

Began human factors and physical property evaluations of MULO IME candidates.

NBC Protective Covers

The NBC Protective Cover is designed to reduce contamination of bulk supplies and equipment from nuclear fallout debris and airborne field concentrations of chemical and biological agents. This cover will be designed to be inexpensive, disposable, and easy to handle.

During FY85:

Prepared commercial covers/materials for evaluation.

Obtained foreign candidate covers for evaluation.

Field-evaluated tarpaulin and roll concepts.

Chemical Protective Shelters

During FY85:

Completed the engineering design test of the CB Extendable Rigid Wall ISO Shelter.

Incorporated corrections to deficiencies into the contract for the prototype one-side and two-side expandable CB Rigid Wall ISO Shelters.

Conducted a preliminary design review and awarded a contract for two prototype Chemical Biological Electromagnetic Interference (CB/EMI) Rigid Wall ISO Shelters.

NBC Survivability:

The objectives are: to provide technical support and guidance to materiel developers in implementing AR 70-71, Nuclear, Biological, and Chemical (NBC) Contamination Survivability of Army Materiel; to conduct general studies on NBC vulnerability/survivability; and to identify technical base studies to fulfill knowledge gaps and enable systems and personnel survival in the NBC environment.

During FY85:

Established an NBC Survivability Office.

Provided, to all major subordinate commands and Project Managers within AMC, data on the characteristics of AR 70-71, the interaction of chemical agents and decontaminants on materiel, and techniques available to mitigate their effects and foster survivability.

Prepared an intensive program which has given rise to methodology development for survivability assessment; guidance handbooks for materiel developers to facilitate contractual support for survivability; engineering design handbooks; sensitivity studies to assess the effect of changes in decontaminability criteria on unit performance; and test technology investigations.

Implemented international coordination of survivability requirements.

(3) Chemical Detection and Warning Material

Automatic Liquid Agent Detector (ALAD): XM86

ALAD is an automatic liquid chemical agent detector unit that detects a single drop of threat agents such as thickened GD, VX, H, and Lewisite. The detection mechanism is based on the physical-chemical interaction of the agent with a special paint resin in which there are very fine elemental silver flakes suspended. This silver-bearing paint acts as an electrical conductor, which swells when attacked by an agent, causing physical separation of the conductive silver flakes and a resulting change in the electrical resistance of the detector grid. This change activates an alarm function. (The major components are the detector unit and the insertable sensor element.)

The ALAD program was officially made two separate programs, one to address the liquid agent threat (ALAD) and one to address the development of a communication line Chemical Agent Detector Network (CADNET).

The objective of this program is to complete development, and Test and Evaluation of an Automatic Liquid Agent Detector (ALAD) under a joint program with the Air Force. The ALAD will be designed and fabricated to meet the requirements of both services.

During FY85:

Restructured the Automatic Liquid Agent Detector: XM85/86 (ALAD) to show two projects, ALAD and CADNET.

Established the framework for a joint program (Air Force and Army).

Modified the advanced development (AD) contract to refurbish AD hardware for test and evaluation, and to obtain some small liquid agent detectors for Army full Concept Evaluation Program.

Chemical Agent Detector Network (CADNET):

The Chemical Agent Detector Network (CADNET) will provide a rapid warning and reporting system for chemical agent detectors and will disseminate critical NBC information on the battlefield. CADNET will consist of a common radio frequency (RF) module which will interface with the detectors (initially XM21, XM22, and XM86) and a central alarm unit. The network will transmit a warning within a company and also provide warning to adjacent companies within a battalion, significantly improving warning and reporting throughout the battalion area. The information available in CADNET will be transmitted to the battalion level via standard communication networks.

During FY85:

Initiated Advanced Developed Program.

Conducted trade-off analysis.

Demonstrated operational concept using surrogate components.

Multipurpose Integrated Chemical Agent Detector (MICAD):

The MICAD System is an integrated chemical agent detection system that will provide an inside and/or outside detection capability to air and ground combat vehicles, vans, and shelters protection equipment (PPCPE) or without PPCPE if an automatic communication network is available. The detector portion of the MICAD system will utilize an XM22 ACADA. The MICAD system will activate on-board automatic collective protection equipment when agent presence is detected and will interface with the communication headphones within the vehicle, van, or shelter.

During FY85:

Obtained an approved Operational and Organizational (O&O) Plan.

Completed market survey.

Performed trade-off determination and trade-off analysis.

Initiated application survey, program documentation for Milestone I/II, and development procurement request package.

Conducted a Test Integration Working Group meeting.

Assisted U.S. Army Chemical School in drafting the Letter of Agreement (LOA) and in preparing the Cost and Operational Effectiveness Analysis (COEA).

Restructured program to go to Full Scale Development.

Remote Sensing Chemical Agent Alarm, XM21 (SCI-REACH):

This system will detect nerve agent clouds at a distance of up to five kilometers. The alarm will automatically scan a 60-degree horizontal arc and operate unattended up to 12 hours.

During FY85:

Successfully completed Development Testing (DT I). Conducted Operational Testing (OT I) with emerging results indicating a need to refine the Operations and Organization (O&O) concepts.

Designed the Acceptance Inspection Equipment (AIE).

Incorporated Mustard and Lewisite vapor detection capability.

Developed and tested the "moving background" feasibility algorithm.

Automatic Chemical Agent Alarm, XM22:

The objective is to develop a multi-agent alarm with the capability to serve as a point sampling alarm, as a monitor inside collective protected shelters, and as a surface monitor to detect contaminated surfaces and determine the effectiveness of decontamination.

The XM22 program was accelerated to end with Type Classification for Limited Production in FY87.

During FY85:

Completed fabrication and testing of fifteen (15) prototype models to demonstrate agent detection capability and system survivability.

Conducted Joint Service Integrated Logistics Support reviews and Test Integration Working Group (TIWG) meetings.

Completed a Resource Management Plan and Test and Evaluation Master Plan.

Nuclear, Biological and Chemical Reconnaissance System (NBCRS):

The objective is to develop a system which integrates a variety of sensors/detectors, and auxiliary subsystems into selected vehicles to conduct nuclear, biological, and chemical (NBC) reconnaissance. This system will collect and report NBC contamination information faster and more accurately than what is currently possible, and will be capable of operating with conventional reconnaissance forces. This system will contain chemical and nuclear detectors, a (partial) meteorological system, a navigation system, a manual sensor data input to the communication system, and manual sampling and marking systems.

During FY85:

Obtained an approved Operational and Organizational (O&O) Plan.

Conducted market surveys.

Performed trade-off determination and analysis.

Prepared and obtained an approved Letter of Agreement and required program documents.

Held Milestone I In-Process Review.

Demonstrated that mobile NBC reconnaissance, as part of the conventional reconnaissance team, is possible and that the NBCRS and its equipment can be operated by chemical equipment operators, personnel with a military occupation speciality (MOS) of 54B, and cavalry scouts with a MOS of 19D.

Prepared and issued the Request for Proposal (RFP) for the four-year development contract.

Reconnaissance Concept Evaluation Program (CEP):

The objective of the Reconnaissance CEP effort was to provide the U.S. Armor and Engineer Board and the U.S. Army Chemical School with a M113A2 Reconnaissance Test Bed Vehicle for CEP testing. The CEP testing is conducted to assist in the development of doctrine on how the reconnaissance vehicle is to be utilized on the battlefield, and to assist in the development of the requirements documentation.

During FY85:

Conducted a Phase I Reconnaissance CEP test using the first test bed vehicle equipped with a German Mass Spectrometer (GEMS) for soil sampling, a VDR-2 Radiac for radiation monitoring, a soil sampling mechanism for on-the-move reconnaissance (as well as stationary soil point sampling), a Chemical Agent Monitor (CAM) for dismount sampling, a land navigation system, a digital communications terminal and printer, a marker flag discharge mechanism, and a manual sampling gloveport. The test was successful in demonstrating a vehicle reconnaissance capability.

Conducted a Phase II Reconnaissance CEP test. Improvements in the system included upgrading the meteorological sensor package on the vehicle and the digital interfacing between the GEMS and the digital communications terminal.

Initiated fabrication of a second test bed vehicle. This vehicle will be equipped with an overpressure and microcooling system. All other vehicle capabilities will be similar to the other test bed vehicle.

Initiated the integration of all the vehicle sensors into the digital communications terminal and initiated the automation of the soil sampling mechanisms.

(4) <u>Medical Defense Against Chemical Warfare</u>

The objectives of this program are to establish kinetic relationships that will permit formulations of new pretreatment and therapeutic drugs to support new drug applications (NDA) with the FDA; to perform advanced development of chemotherapeutics that will prevent or minimize injury due to chemical warfare agents; and to determine the technical and operational effectiveness of the life support equipment.

During FY85:

Evaluated the nuclear, biological and chemical casualty heart rate monitor prototypes.

Evaluated prototypes of the nuclear, biological, and chemical casualty vital signs monitor.

Awarded contracts to three firms for the advanced development of the on-site medical oxygen generation systems. Began design, prototype construction and engineering tests on the three competing prototypes.

Tested both manual and gas powered resuscitator prototypes.

Completed design and development of the high capacity radiographic/fluoroscopic system for diagnostic imaging.

Developed potential formulations of aerosolized nerve agent antidote and evaluated potential delivery devices for this and other aerosolized drugs.

Awarded the transdermal drug delivery system contract.

Developed a long acting oral formulation of a nerve agent pretreatment drug.

Initiated an effort to develop an effective model for testing the efficacy of a nerve agent pretreatment compound.

Identified a decontamination resin product for use on skin.

(5) <u>Medical Chemical Defense Life Support Material</u>

Determined that the pretreatment drug, pyridostigmine, does not adversely affect respiratory functions in exercising laboratory animals.

Established that pyridostigmine-induced muscle degeneration was partially recovered twenty-one (21) days after final administration.

Developed large scale purification of acetylcholinesterase from fetal bovine serum.

b. General Chemical Investigations: Exploratory Development

Chemistry and Effects of Threat Agents

The objective is to identify, synthesize, and characterize potential threat agents; to maintain modern technology in toxicology, chemometrics, and analytical, organic and physical chemistry to support the chemical defense effort; and to produce simulants for chemical agents and simulant technology for chemical defense systems.

During FY85:

Identified a new family of threat chemical agents and incorporated studies of top priority compounds within this family into threat chemical agent programs.

Developed several in vitro assays as supplements or alternatives to in vivo whole animal toxicology tests.

Developed state-of-the-art analytical techniques for the analysis of tricothecenes and other intermediate weight toxins.

Analysis and Integration of Chemical Defense Systems

The objectives of this program are to develop mathematical modeling techniques and the data base to assess the foreign chemical and biological threat and evaluate the chemical and biological defense systems against the threat; to develop new models to estimate the effects of chemical warfare agents on the battlefield and to use these models for the assessment of alternative concepts and designs and to provide other Department of Defense chemical analysts and wargamers with mathematical models and methodology for their analyses.

During FY85:

Established analytical methodology for contact hazards.

Established facilities for Individual Protective Equipment vulnerability studies.

Completed the development of methodology for the JANUS Wargame in support of Chemical and Nuclear Environment Force Development, Testing, and Experimentation (CANE FDTE).

Completed a hierarchy of wind flow models to characterize wind flow patterns as a function of terrain and synoptic meterological information. Initiated a field test program to evaluate these models.

Completed a simplified methodology for characterization of persistent chemical agent attacks for incorporation into the JANUS wargaming model.

Chemical Biological Defense Data Collection and Systems Science

The objectives of this program are to identify generic and fundamental CB defense data needs and development areas; to acquire or develop special test technologies, experimental data for data bases in chemistry, physics, toxicology, biology and operational sciences for application in all functional areas; and to provide Nuclear Biological Chemical (NBC) Survivability Technology base data.

During FY85:

Established a Biotechnology Data Base.

Measured the thermal properties of selected toxins.

Tested a foreign protective mask to assess its capability.

Initiated studies of aircraft components and electronics survivablity in a Chemical Biological (CB) environment.

Chemical Protective Clothing and Equipment:

Hazard Assessment, Systems Analysis, Experimental Design and Materials for Chemical Protection:

The objective of this program is to develop materials for use in chemical protective clothing and equipment.

During FY85:

Evaluated the Battledress Overgarment to determine its final protective limits. Test data support an extension of service life from six (6) hours protection following 14 days wear to twenty-four (24) hours protection following 30 days wear.

Prepared experimental design plans to evaluate the wear life and agent protection of candidate materials for the next generation chemical protective garment, the Enhanced Chemical Protective Suit.

Completed development and distributed user guides for a computerized data base to store and retrieve information on the interactions of agents, simulants, and decontaminants on materials.

Investigated effects of cleaning/decontamination of carbon impregnated foam and other chemical protective materials. Developed a comprehensive evaluation methodology to assess the potential for reuse of chemical protective materials following decontamination.

Developed procedure guides for the U.S. Air Force Commissary Service (AFCOMS) that provide detailed task flow charts and specific recommendations for the adequate storage, handling, distribution, and survivability of food supplies at Air Force bases exposed to Nuclear Biological Chemical (NBC) attack.

Investigated Navy Food Service operations to define new food service concepts for ships vulnerable/exposed to Chemical Biological (CB) attack.

Improved casualty estimation algorithms incorporated in widely used chemical warfare simulation programs. In particular, algorithms were developed which more accurately predict casualties and dose-response as a function of various time parameters (start of attack, alarm activation, soldier response to attack, etc.), and time-dependent parameters (protective posture, agent concentration, etc.).

Developed chemical protective materials for use in improved overgarments.

Continued development of impermeable, flame resistant fuel and acid resistant chemical protective materials for special purpose explosive ordnance disposal and decontamination operations.

Developed improved semi-permeable membranes with optimized properties for increased comfort and increased chemical agent resistance.

Developed improved elastomers and barrier materials for gloves, boots, and protective covers.

Continued or awarded new contracts in the following areas:

The development of durable flame resistant protective fabrics based on sorptive carbon spheres. This work is designed to optimize durability, chemical protection, flame resistance, launderability and cost of these fabrics.

The development of carbon-impregnated microporous fabrics. This work is designed to optimize the chemical protection of carbon particles or fibers in a thin hydrophobic membrane while minimizing heat stress by facilitating body moisture evaporation.

The development of a system for low temperature reactivation of activated carbon. The system is being designed to interface with both the existing aqueous laundering systems and the new dry cleaning/decontamination system currently under development.

Optimization of materials containing reactive resins. Non-woven systems including foam matrices were treated with reactive resins. The materials are currently being tested for chemical agent resistance.

Contracts for testing, test materials, testing procedures, and reporting of test results were assessed and coordinated to provide uniform protocols and results compatible with the Natick Research and Development Center CD Data Base and also with the PLASTEC Chemical Biological Data Bank, Picatinny Arsenal. Additional test contractors were acquired to accommodate increased workload requirements.

Conducted research to develop an enzyme formula to decontaminate/launder protective clothing. Isolated a bacterial enzyme that catalyzes Soman hydrolysis when mixed with various detergents, and identified one commerical detergent that alone also catalyzes Soman hydrolysis.

2. LETHAL CHEMICAL PROGRAM

a. Exploratory Development

The objectives of this program are to develop chemical agent/munition systems to provide a dependable and credible deterrent and a safe and modern retaliatory capability; and to maintain advanced technology in agent chemistry weaponry to avoid any technological lag or surprise.

During FY85:

Investigated new binary intermediate compounds that could be used for binary reactions.

Evaluated innovative approaches for developing improved mixing systems for bulk payload type binary bombs.

Initiated the development of a Front End Analysis (FEA) for retaliatory chemical munitions (RCM). A draft Master Plan for RCM was also started.

Completed the sub-chronic toxicology study for chemical intermediates of a binary agent.

Continued air gun chamber tests to relate agents and simulants in terms of viscoelastic properties and dissemination characteristics.

Agent Pilot Plant Investigations: The objective is to prove out and scale up production processes beyond laboratory scale quantities.

During FY85:

Continued pilot plant investigations in consonance with the new agents and materials program to evolve large scale chemical processing concepts for agents and intermediates. Continued research for mechanical filling and closure techniques for various munition concepts.

b. Advanced Development

Tactical Weapons System:

(1) XM135 Multiple Launch Rocket System (MLRS) Binary Chemical Warhead

Continued the validation phase of the XM135 MLRS.

Developed two chemical agent simulants for assessing the performance of the XM135 MLRS.

Fabricated and tested with simulants a full scale warhead spin reactor. A 1/100 scale warhead laboratory reactor was designed and fabricated for conducting thickened agent tests.

(2) M687 Binary 155mm Projectile

Initiated a Product Improvement Program (PIP) for the M687 to replace the current composite aluminum/steel base with a domed steel base.

Fabricated projectiles, canisters filled with simulants, domed steel bases and side loading pallets. Assembled and shipped the initial quantity of test projectiles to the test site.

c. Full Scale Development No obligations were incurred.

d. Testing

(1) Materials Tests in support of Joint Operational Plans and/or Service Requirements.

Continued engineering support and testing for the U.S. Navy and the U.S. Air Force in the Development Testing II (DT II)/Operational Testing II (OT II) phases of development of the BIGEYE BLU-80/B Binary Bomb.

Tested the BIGEYE bombs for adequacy of the bomb's components and the binary reaction. The bombs were also subjected to a series of environmental and adverse handling conditions.

Designed, fabricated, and structurally qualified a new full scale reactor for high pressure agent testing.

Filled with simulant, sealed, and forwarded forty-eight (48) bombs and twenty-two (22) separation test vehicles to U.S. Navy and U.S. Air Force flight test centers.

Verified the bomb's fill and close Technical Data Package.

(2) Army Material Suitability Tests.

Successfully flight tested eleven (11) XM135 MLRS binary chemical warheads filled with simulant.

Successfully tested approximately eighty (80) BIGEYE BLU-80/B Binary Bombs and associated safe separation test vehicles.

3. INCAPACITATING CHEMICAL PROGRAM

a. Exploratory Development

The objectives of this program are to discover new quick acting physically incapacitating compounds which are effective by inhalation and absorption through the skin; and to synthesize and evaluate potent analgesics and volatile anesthetics.

During FY85:

Continued the study of intermediate volatility agents and simulants. Expanded the area of interest in the search for new incapacitating agents.

b. Advanced Development

No obligations were incurred.

c. Full Scale Development

No obligations were incurred.

d. Testing

No obligations were incurred.

4. DEFENSIVE EQUIPMENT PROGRAM

a. Exploratory Development

(1) Physical Protection Investigations

Chemical and Biological Decontamination and Contamination Avoidance

The objectives of this program are to investigate procedures, designs and materials to enhance survivability of troops in a chemical, biological and radiological environment; to develop equipment to decontaminate personnel, personal items and military equipment; to improve the efficiency of the decontamination process; and to develop methods of avoiding or minimizing contamination.

During FY85:

Completed contractual evaluation of Multipurpose Chemical Biological Decontaminant (MCBD) with a recommendation to continue pursuit of a surfactant based system.

Began in-house agent testing of the commercially available Quadrex decontaminating unit utilizing a fluorocarbon solvent.

Awarded a contract to propose and estimate the cost effectiveness of four different levels of automation for six (6) new decontamination methods.

Began agent testing on prototype self-decontaminating films.

Awarded contractual efforts for five (5) different aircraft decontaminating systems.

Solicited new methods for aqueous and non-aqueous decontamination from industry and academia. Twelve (12) proposals were selected for further study.

Individual Protection

The objectives are to evolve concepts for individual protection against potential threat agents for joint service application; to develop a technical base to study the mechanism of chemical biological protective materials; and to maintain a center of excellence in respiratory protection.

During FY85:

Improved respiratory protection devices through applied anthropometric and computer aided manufacturing methods.

Developed and exploited condensation nuclei counter technology in the assessment of individual protection items.

Initiated investigations for use of new technologies for agent removal and closed circuit respiratory operation, e.g. hemo-sponge.

Evaluated concepts of agent resistant faceblank materials, quick-doff hood concepts, canister interoperability, and improved communications. All were transitioned to an XM40 Pre-planned Product Improvement Program.

Investigated eight (8) possible design concepts for a low resistance canister. Four (4) designs were deemed practical. Began fabrication of forty (40) canisters of each design selected for prototype development.

Completed testing of a combat vehicle crewman's chemical protective, flame resistant uniform. This new uniform will eliminate the current requirement of wearing the chemical protective overgarment over the flame resistant coveralls.

Conducted research on human factors problems associated with human waste elimination while wearing chemical protective ensembles. A prototype human waste system for use with a modified chemical protective suit design has been developed.

Completed the evaluation of the Demo 84 concept. Input from the evaluation was used to improve the design of the ensemble in Demo 85. This new ensemble combines the state of the art technology of various disciplines including chemical protection, microclimate conditioning, ballistics and flame protection, through-mask feeding and waste elimination capabilities during complete encapsulation.

DEPARTMENT OF DEFENSE

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

RCS: DD-USDRE(A) 1065

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DEPARMTMENT OF DEFENSE

ANNUAL REPORT ON CHEMICAL WARFARE AND

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INDEX

DEPARTMENT OF DEFENSE

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BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

FOR THE PERIOD 1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

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(ACTUAL DOLLARS)

	ARMY	NAVY AND MARINE CORPS	AIR FORCE	TOTAL
CHEMICAL WARFARE PROGRAM	235,168,000	19,823,000	30,986,000	285,977,000
RDTE	235,168,000	19,823,000	30,986,000	285,977,000
BIOLOGICAL DEFENSE RESEARCH PROGRAM	66,905,000	1,623,000	-0-	68,528,000
RDTE	66,905,000	1,623,000	-0-	68,528,000
ORDNANCE PROGRAM	94,125,000	-0-	-0-	94,125,000
RDTE	18,314,000	-0-	-0-	18,314,000
PROCUREMENT	75,811,000	-0-	-0-	75,811,000
TOTAL PROGRAM	396,198,000	21,446,000	30,986,000	448,630,000
RDTE	320,387,000	21,446,000	30,986,000	372,819,000
PROCUREMENT	75,811,000	-0-	-0-	75,811,000

DEPARTMENT OF DEFENSE

ANNUAL REPORT ON CHEMICAL WARFARE AND

BIOLOGICAL DEFENSE RESEARCH HUMAN TESTING

1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

THERE HAVE BEEN NO STUDIES CONDUCTED WITHIN THE DEPARTMENT OF DEFENSE DURING THE REPORTING PERIOD THAT INVOLVED THE USE OF HUMAN SUBJECTS FOR TESTING OF CHEMICAL OR BIOLOGICAL AGENTS.

ANNEX A

DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

RCS: DD-USDRE (A) 1065

DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

SECTION I

OBLIGATION REPORT ON CHEMICAL WARFARE PROGRAM

FOR THE PERIOD 1 OCTOBER 1984 THROUGH 30 SEPTEMBER 1985

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

DESCRIPTION OF RDTE EFFORT FOR THE CHEMICAL WARFARE PROGRAM

During FY85, the Department of the Army obligated $235,168,000 for general research investigations, development and test of chemical warfare agents, weapons systems and defensive equipment.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$228,808,000	
Prior Year (PY)	6,360,000	
		In-House $ 69,260,000
TOTAL	$235,168,000	Contract $165,908,000

Breakdown of Program Areas

1. **CHEMICAL RESEARCH**

a. Basic Research in Life Sciences	CFY	$ 16,016,000	
	PY	688,000	
			In-House $ 7,266,000
		$ 16,704,000	Contract $ 9,438,000
b. General Chemical Investigations Exploratory Development	CFY	$ 11,502,000	
	PY	-0-	
			In-House $ 6,090,000
		$ 11,502,000	Contract $ 5,412,000
TOTAL; CHEMICAL RESEARCH	CFY	$ 27,518,000	
	PY	688,000	
			In-House $ 13,356,000
		$ 28,206,000	Contract $ 14,850,000

2. LETHAL CHEMICAL PROGRAM

a. Exploratory Development	CPY	$ 6,742,000		
	PY	-0-		
			In-House $	4,686,000
	$ 6,742,000		Contract $	2,056,000
b. Advanced Development	CPY	$ 10,116.000		
	PY	-0-		
			In-House $	923,000
	$ 10,116,000		Contract $	9,193,000
c. Full Scale Development		$ -0-		
d. Testing		$ 400		
			In-House $	0
			Contract $	400
TOTAL: LETHAL CHEMICAL PROGRAM	CPY	$ 17,258,000		
	PY	-0-		
			In-House $	5,609,000
	$ 17,258,000		Contract $	11,649,000

3. INCAPACITATING CHEMICAL PROGRAM

a. Exploratory Development	CPY	$ 3,528,000		
	PY	-0-		
			In-House $	2,283,000
	$ 3,528,000		Contract $	1,245,000
b. Advanced Development		$ -0-		
c. Full Scale Development		$ -0-		
d. Testing		-0-		

TOTAL: INCAPACITATING CHEMICAL PROGRAM	CFY	$ 3,528,000	
	PY	$ -0-	
		$ 3,528,000	In-House $ 2,283,000
			Contract $ 1,245,000
4. DEFENSIVE EQUIPMENT PROGRAM			
a. Exploratory Development			
(1) Physical Protection Investigations	CFY	$ 14,591,000	
	PY	-0-	
		$ 14,591,000	In-House $ 6,737,000
			Contract $ 7,854,000
(2) Warning and Detection Investigations	CFY	$ 15,166,000	
	PY	-0-	
		$ 15,166,000	In-House $ 5,093,000
			Contract $ 10,073,000
(3) Medical Defense Against Chemical Agents	CFY	$ 31,037,000	
	PY	496,000	
		$ 31,533,000	In-House $ 14,710,000
			Contract $ 16,823,000
TOTAL: Exploratory Development	CFY	$ 60,794,000	
	PY	496,000	
		$ 61,290,000	In-House $ 26,540,000
			Contract $ 34,750,000

b. Advanced Development

(1) Chemical Decontaminating Material	CFY	$ 1,459,000	
	PY	-0-	
		$ 1,459,000	In-House $ 1,048,000
			Contract $ 411,000
(2) Collective Protection Equipment	CFY	$ 3,215,000	
	PY	-0-	
		$ 3,215,000	In-House $ 1,660,000
			Contract $ 1,555,000
(3) Chemical Detection and Warning	CFY	$ 39,126,000	
	PY	-0-	
		$ 39,126,000	In-House $ 5,108,000
			Contract $ 34,018,000
(4) Medical Defense Against Chemical Warfare	CFY	$ 20,707,000	
	PY	-0-	
		$ 20,707,000	In-House $ 1,972,000
			Contract $ 18,735,000
(5) Medical Chemical Defense Life Support Material	CFY	$ 30,610,000	
	PY	5,175,000	
		$ 35,785,000	In-House $ 4,642,000
			Contract $ 31,143,000
TOTAL: Advanced Development	CFY	$ 95,117,000	
	PY	5,175,000	
		$100,292,000	In-House $ 14,430,000
			Contract $ 85,862,000

c. Full Scale Development

(1) Decontamination Concepts and Material	CFY	$ 4,750,000		
	PY	-0-		
		$ 4,750,000	In-House $	1,134,000
			Contract $	3,616,000
(2) Collective Protective Systems	CFY	$ 4,271,000		
	PY	-0-		
		$ 4,271,000	In-House $	1,586,000
			Contract $	2,685,000
(3) Warning and Detection Equipment	CFY	$ 1,300,000		
	PY	-0-		
		$ 1,300,000	In-House $	706,000
			Contract $	594,000
(4) Individual Protection Equipment	CFY	$ 9,110,000		
	PY	-0-		
		$ 9,110,000	In-House $	2,464,000
			Contract $	6,646,000
(5) Medical Chemical Defense Life Support Material	CFY	$ 2,817,000		
	PY	1,000		
		$ 2,818,000	In-House $	400,000
			Contract $	2,418,000
d. Testing	CFY	$ -0-		
	PY	-0-		
		-0-	In-House $	-0-
			Contract $	-0-
TOTAL: Full Scale Development	CFY	$ 22,243,000		
	PY	1,000		
		$ 22,249,000	In-House $	6,290,000
			Contract $	15,959,000

TOTAL: DEFENSIVE EQUIPMENT PROGRAM	CPY	$178,159,000		
	PY	5,672,000		
			In-House	$ 47,260,000
		$183,831,000	Contract	$136,571,000
5. TRAINING SUPPORT				
a. Training	CPY	$ -0-		
	PY	-0-		
			In-House	$ -0-
TOTAL: TRAINING SUPPORT		$ 0-	Contract	$ -0-
6. SIMULANT TEST SUPPORT	CPY	$ 2,345,000		
	PY	-0-		
			In-House	$ 752,000
TOTAL: SIMULANT TEST SUPPORT		$ 2,345,000	Contract	$ 1,593,000

EXPLANATION OF OBLIGATION

1. CHEMICAL RESEARCH

a. Basic Research in Life Sciences

This research provides a science base to support:

(1) Chemical Defense Research. This program includes new concepts and the elucidation of mechanisms of decontamination and contamination avoidance, individual and collective protection, chemical detection, identification and alarms, materials research, simulants, and training systems.

(2) Chemical Retaliatory Research. This area includes research on chemical munitions, a search for new classes of chemical agents, and studies on the reactions and properties of chemical threat agents.

During FY85:

Demonstrated the potential of Surface Enhanced Raman Spectroscopy (SERS) for simulant and agent testing.

Developed an algorithm for computer designing compounds of interest to the chemical agent program. A series of compounds were proposed for synthesis in the incapacitating agent program.

Studied the effects of model compounds on ion flux in acelylcholine receptor ion channels and selected cells in order to develop *in vitro* tests as alternatives or supplements to whole animal tests.

Received a new mathematical model for plasma dynamics which treats dispersion, deposition, and evaporation of aerosol clouds produced by a continuous source.

Identified additives to reduce the volatility of diesel oil. If successful, this could replace fog oil.

Determined that Freon-22 is a feasible trace gas for use as a self-administered test for residual life of charcoal canisters.

Awarded a contract to the University of Pittsburgh to establish a center of excellence for Biotechnology with emphasis placed on protein engineering and receptor site research for biomicrosensors.

Clothing Shelters and Other Material Systems

The goal of this program is to develop technology for the development of clothing and other protective material systems that will minimize the effects of chemical/biological agents.

During FY85:

Found that cholinesterase enzyme binds to the nerve agent Soman and to some nerve agent simulants.

Isolated, purified, and partially characterized an enzyme, from culture filtrates of a fungus, with activity against a constituent of nerve agent VX and other compounds.

Developed methods to chemically modify three cyclodextrins to enhance the known catalytic activity of the parent cyclodextrins and to optimize chemical warfare (CW) decontamination.

Employed a spectroscopic technique to measure the binding and detoxifying properties of CW protective substances. Used electron paramagnetic resonance spectroscopy to study the interactions of organophosphonates (G agents and appropriate surrogates) with fabrics which incorporate protective compounds.

Attached a reactive chemical group (hydroxamate) to a biopolymer and conducted studies showing this modified biopolymer detoxifies a G agent surrogate.

Studied the internal features of chemical agent adsorbing encapsulated carbon Von Blucher spheres found in CW protective clothing using thin sectioning and microscopy.

Conducted studies to determine if CW protective treatments were compromised by biocides. (Biocides are used to protect materials from microbial breakdown.)

Conducted laboratory studies to examine cognitive performance as a function of time in full protective clothing (MOPP-4). Studied the effectiveness of behavioral and environmental preconditioning in preventing performance degradation.

Developed methodology for measuring the surface parameters which affect the wetting and penetration of fabrics. Previous methods for placing, observing, and photographing a drop on a fabric surface were modified to greatly reduce the time required for each measurement.

Medical Chemical Defense Research Program

This program addresses the medical defense against chemical agents. The objectives are to increase combat effectiveness and improve soldier survivability. Emphasis is placed on development of new technologies and methodologies to evaluate biological effects resulting from the current and potential chemical warfare agents and therapies. The results of this work are transitioned to exploratory development.

During FY85:

Established guinea pig stereotoxic atlas for acetylcholinesterase in the central nervous system for testing pretreatment/antidotes.

Determined cholinergic pathways in retina of laboratory animals. (These data will be used to study organophosphorus effects on visual functions).

Determined that Soman causes increased hearing thresholds in guinea pig models.

Established a house fly model for evaluating potential antidotes to organophospates.

Developed cell cultures to provide a non-living source of acetylcholinesterase.

Developed a model to study neurotransmitter (e.g. Glutamate) effects of chemical warfare agents.

Determined aprophen, an antidote compound, pharmacokinetics and distribution in the body organs of the rat.